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Acute Leg Ischaemia from Thrombosed Popliteal Artery Aneurysms: Role of Preoperative Thrombolysis

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Objective: *to evaluate early and long term results of thrombolysis and surgery in acutely thrombosed popliteal artery aneurysms.*
Setting: *retrospective study; teaching hospital.*
Materials: *between 1990 and 2000, 109 popliteal artery aneurysms were operated on. In 24 patients acute leg ischaemia due to thrombosis of aneurysm was present.*
Methods: *ten patients underwent urgent surgical intervention (group 1); and 14 thrombolysis with urokinase, until patency of popliteal and tibial vessels was achieved or for a maximum of 3 days (group 2). Ultrasonographic follow-up was performed at 1, 3, 6 and 12 months and then annually. Early results and follow-up data were analysed by chi-square test and life-table analysis (Kaplan–Meier curve) and late results were compared by mean of log rank test.*
Results: *in group 1 early limb salvage was 70%; in group 2 it was 86% (p = n.s.). When thrombolysis was successful, patency and limb salvage were 100%. There was no local or systemic complications during thrombolysis nor worsening of ischaemia. Follow-up was completed in 91 cases, with a mean duration of 26 months. Forty-eight months primary patency rate was better, even if not statistically significant, in group 2 than in group 1.*
Conclusions: *in patients with acute leg ischaemia due to thrombosis of popliteal artery aneurysms, preoperative thrombolysis can be considered a safe and effective alternative to urgent surgery.*

Key Words: Popliteal aneurysm; Acute ischaemia; Thrombolysis.

Introduction

Acute leg ischaemia due to popliteal artery aneurysm thrombosis remains a dangerous complication with a high incidence of limb loss.[1]

The results of urgent surgical intervention are less satisfactory than those of elective intervention.[2] In recent years, a combination of thrombolysis and surgery has been proposed.[1]

In this paper we analyse the results of our experience with preoperative thrombolysis in patients with acute leg ischaemia due to thrombosed popliteal artery aneurysms. We compare early and long term results with results in a group of patients undergoing urgent surgery alone.

Materials and Methods

From January 1990 to December 2000 109 popliteal artery aneurysms in 89 patients were operated on at our institution; 20 patients had bilateral aneurysms (18%). Patients were predominantly males (85 patients, 96%), with a mean age of 66 (range 28–91).

Aneurysms were asymptomatic in 58 cases (53%); three aneurysms had ruptured (3%); and in 24 cases chronic leg ischaemia was present (22%). The remaining 24 patients had acute grade I or IIa limb ischaemia due to thrombosis.[3] Duplex scanning and digital subtraction angiography were immediately performed. In 10 cases (from 1990 to 1994) urgent surgical intervention was immediately performed (group 1). In 14 cases (from 1995 to 2000) preoperative catheter-directed thrombolysis with urokinase was performed via the contralateral common femoral artery (group 2).

Thrombolytic treatment was administered as a bolus of 100 000 I.U., followed by continuous infusion (50 000–70 000 I.U./h). At the same time 1000–1500 I.U./h of sodium heparin was administered via the same catheter, so to maintain values of aPTT two times higher than normal value.

Angiographic controls were taken at least daily. Thrombolysis continued until patency of popliteal and

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tibial vessels was achieved or for a maximum of 3 days when unsuccessful.

The levels of fibrinogen and haemoglobin and the values of INR and aPTT were monitored twice daily. Group 2 patients underwent surgical revascularisation no later than three days after the end of thrombolysis. In the meantime they continued to receive intravenous sodium heparin.

Surgery comprised proximal and distal ligature of the aneurysm with bypass grafting in 12 cases; and of aneurismectomy with prosthetic interposition in seven cases. In five cases the aneurysm was opened and a graft was placed inside the aneurysm in fashion similar to that used to repair aortic aneurysms.[4] A medial approach was used in 13 cases (54%) and posterior approach in 11 cases (46%). Graft material consisted of autologous vein in 10 cases and prosthetic graft in 14 cases. There were no differences between group 1 and 2 in the use of graft versus vein.

Early results in terms of mortality and amputation rates were analysed by mean of chi-square test.

Univariate and multivariate analysis (stepwise logistic regression analysis) of angiographic features (patency of 1, 2 or 3 run-off vessels) and intraoperative variables (inflow and outflow anastomotic sites, kind of interventions, graft materials) for 30 days perioperative risk of amputation in patients with acute ischaemia were performed.

Clinical and duplex-scanning follow-up was performed at 1, 3, 6, 12 months and then once a year. All studies were performed using the Acuson Sequoia 512 Ultrasound System (Acuson Corporation, Mountain View, CA, U.S.A.). A 8L5 linear array probe with an operating frequency of 8.0 to 5.0 MHz was used in all the cases.

Follow-up data were analysed in terms of primary patency and limb salvage rates by life-table analysis (Kaplan–Meier curve) and results in different groups were compared by mean of log-rank test. Statistical analysis was done by mean of SPSS 10.0 software for Windows (SPSS Inc., Chicago, Ill, U.S.A.).

Results

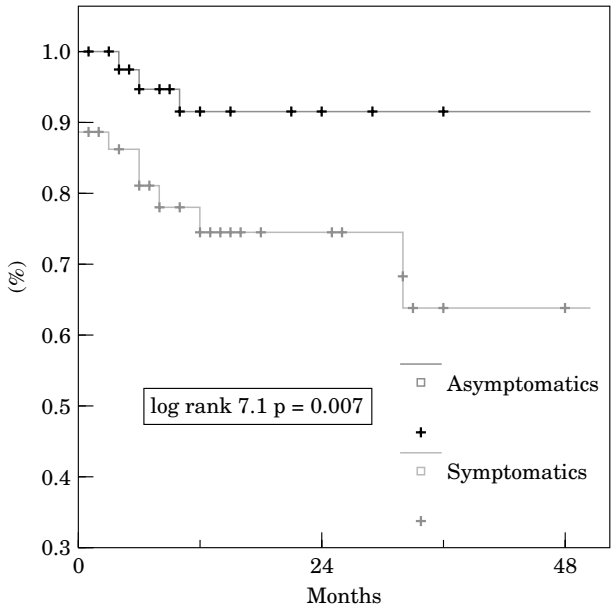
In the whole group of 109 interventions there were no perioperative deaths and 30 day amputation rate was 4% (five cases).

All the amputations occurred among patients with acute leg ischaemia (21%; $p<0{,}001$ with respect to asymptomatic patients).

In group 1 there were three major amputations, with a 30 day limb salvage rate of 70%. In 10 of 14 patients of group 2, complete patency of popliteal artery and tibial vessels was demonstrated by angiographic controls. In four patients thrombolysis was not able to achieve recanalisation of popliteal and tibial arteries. In two of these patients major amputation was necessary. Considering the "intention to treat" outcome within the thrombolysis group, the early limb salvage rate was 86% ($p=$n.s. vs group 1). In patients with successful thrombolysis, the 30 day primary patency and limb salvage rate after surgical intervention were 100%. There were no local or systemic complications during thrombolysis, and no patients suffered a worsening of ischaemia during treatment.

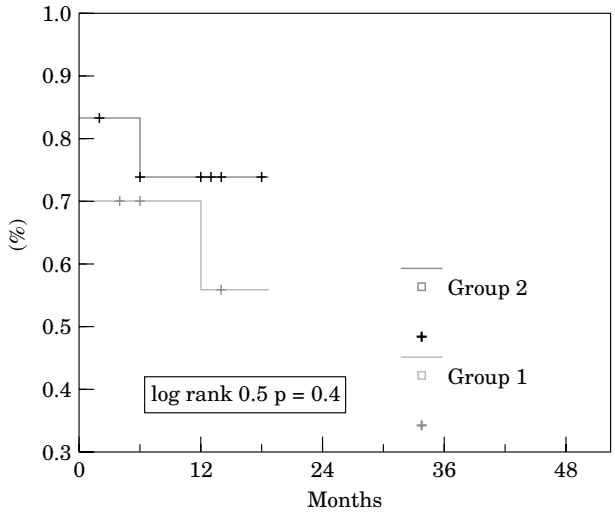
Univariate and multiple regression analysis did not demonstrate any significant influence of the examined parameters on immediate results. Clinical and ultrasonographic follow-up was completed in 91 cases of 109 popliteal artery aneurysms (84%), with a mean duration of 26 months (range 1–120 months). There were four deaths (in all the cases due to cardiovascular diseases). In 10 cases graft thrombosis occurred; this led to three major amputations.

In the whole group of 109 interventions, results in terms of primary patency were better in asymptomatic patients than in symptomatic ones (92% and 64%, respectively; $p=0.007$) (Fig. 1).



Months	0	6	12	24	36	48
Sympt.	51	43	28	19	9	3
Asympt.	58	46	33	18	13	9

Fig. 1. Kaplan–Meier curve: primary patency for symptomatic vs asymptomatic cases with number of patients at risk.



Months	0	6	12
Group 1	10	9	5
Group 2	14	11	7

Fig. 2. Kaplan–Meier curve: primary patency for acute ischaemia (group 1 vs group 2) with number of patients at risk.

Considering the group of patients with acute leg ischaemia, 12 months primary patency rate was numerically higher in group 2 than in group 1 (74% and 56%, respectively); but this did not attain statistical significance (Fig. 2).

Discussion

About two-thirds of popliteal artery aneurysms are symptomatic when first diagnosed.[1,5,6–8] Of particular concern is acute leg ischaemia due to thrombosis and/or embolism.[9]

Urgent surgical intervention in these circumstances carries high risks, and results are poorer than those in asymptomatic patients.[10] Reilly *et al.*[11] reported an amputation rate of 35% in 66 patient with acute thrombosis of popliteal aneurysms, with perioperative mortality of 5%. Halliday *et al.*[12] compared results of surgical intervention in asymptomatic patients (limb salvage and primary patency rates of 100%) with those obtained in urgent surgery for acute ischaemia (amputation rate 5%, graft thrombosis 36%, permanent nerve injury 5%). In these circumstances, surgery is associated with a significant failure rate.[2,10,11,12] As a result, preoperative thrombolysis has been advocated[9,13,14] (Table 1).

In the present study thrombolysis was not associated with a significant improvement in early and long term results. However, thrombolysis was not associated with any significant complications, including bleeding.[19] Nor was there any worsening of ischaemia during thrombolysis.[3,20,21]

Table 1. Main published series in literature from 1990 (long-term results with thrombolysis).

Authors	Procedures (no.)	Follow-up (years)	Primary patency (%)	Limb salvage (%)
Halliday[12]	2	2	100	100
Browse[30]	8	1	100	100
Galland[28]	46	–	–	–
Carpenter[9]	7	5	80	90
Garramone[31]	3	0	100	100
Varga[1]	18	2	72	80
Hoelting[15]	9	4	100	100
Gawenda[32]	13	5	70	75
Taurino[16]	3	4	91	97
Greenberg[20]	5	3	60	100
Steinmetz[17]	15	0	100	100
Present serie	14	3	74	83

Other alternative techniques to surgery have been proposed to reopen the crural arteries; namely, percutaneous aspiration thrombectomy (PAT) and percutaneous mechanical thrombectomy (PMT). The limited available clinical experience suggests that PAT or PMT may be used effectively;[22,23] however trials comparing these methods with standard catheter-directed thrombolysis or surgical thrombectomy are needed to establish their therapeutic role.[18]

In the presence of immediately threatened ischaemia, an alternative to preoperative thrombolysis can be intraoperative thrombolysis, particularly when popliteal artery is patent and tibial vessels are occluded.[24,25]

The commonest complication of catheter-directed thromblysis in management of thrombosed popliteal artery aneurysms is distal embolisation, which accounts for about 10–12% of the cases.[26] In most cases, the situation can be treated by increasing the delivery rate of thrombolytic drug. Although we did not observe any complications in our patients, impairment of ischaemia during thrombolysis, even in the presence of successful recanalisation of popliteal and tibial arteries, has been described, due to distal diffuse microembolisation.[27,28] In these circumstances, immediate surgical intervention seems to give better results than continuation of lysis.

To prevent impairment of ischaemia, it is recommended that, once lysis has been achieved, the patient continues receiving heparin and undergo surgery promptly.[9] These was also our strategy, and no patients suffered from this evenience during thrombolysis or before surgical intervention.

Recently, some little series concerning endovascular treatment of popliteal artery aneurysms have been published:[29] however, data concerning this technique in thrombosed aneurysms are quite poor and this method, at the moment, cannot be recommended and it cannot replace surgical treatment.

Conclusions

Acute leg ischaemia due to thrombosis of popliteal artery aneurysms is a relatively common complication of this disease, whose surgical treatment gives poorer results in terms of graft patency and limb salvage than uncomplicated aneurysms. In this evidence preoperative thrombolysis is a safe and effective alternative to early surgery alone, providing good immediate and long term results. Even if thrombolysis was not able to achieve recanalisation of popliteal artery in all the cases, however, considering the absence of complications in our patients, it is our opinion that it could be attempted to perform a successful surgical intervention.

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